What is claimed is:

1. A method for determining a location of a source of a wireless radio signal comprising steps of:
   a. receiving the wireless radio signal at a plurality of known locations to generate receive signal sample data representative thereof at each known location;
   b. using the receive signal sample data obtained at one of the known locations as a reference waveform, determining the time of arrival of the wireless radio signal at each of the known locations;
   c. computing the time difference between the time of arrival of the wireless radio signal and time of arrival of a reference signal at each of the known locations; and
   d. determining a location of the source of the wireless radio signal based on the time difference of arrival measurements at the plurality of known locations.
2. The method of claim 1, and further comprising the step of generating data associated with reception of the wireless radio signal at each known location, the data including one or more of bandwidth, duration, center frequency and signal strength.
3. The method of claim 2, and further comprising the step of comparing the data associated with reception of the wireless radio signal received at each known location to determine the known location that best receives the wireless radio signal, and wherein the receive signal sample data at the known location that best receives the wireless radio signal is used for the reference waveform.
4. The method of claim 1, and further comprising transmitting the receive signal sample data describing the reference waveform to each of the other known location to enable determination of the time of arrival at those known locations of the wireless radio signal.
5. The method of claim 2, wherein the step of comparing comprises comparing the received signal strength of the wireless radio signal at each of the known

locations and selecting as the reference waveform the receive signal sample data at the known location with the strongest received signal strength.

6. The method of claim 1, and further comprising the steps of transmitting the reference signal, and receiving the reference signal at each of the known locations.

7. The method of claim 6, and further comprising the step of transmitting the reference signal from a first known location.

8. The method of claim 7, and further comprising the step of determining that transmissions of the wireless radio signal occur periodically, and wherein the step of transmitting comprises transmitting the reference signal prior to a transmission of the wireless radio signal.

9. The method of claim 7, and further comprising the step of determining that transmissions of the wireless radio signal occur periodically, and wherein the step of transmitting comprises transmitting the reference signal after a transmission of the wireless radio signal.

10. The method of claim 7, and further comprising the step of determining that transmissions of the wireless radio signal occur aperiodically, and further comprising the step of transmitting the reference signal periodically in an attempt to cause a transmission of the reference signal to occur just prior to or after a transmission of the wireless radio signal.

11. The method of claim 7, and further comprising the step of determining that transmissions of the wireless radio signal occur aperiodically, and further comprising steps of transmitting the reference signal periodically, and continuously storing receive signal data at each of the known locations in a circular buffer in an attempt to capture at least one occurrence of a transmission of the wireless radio signal preceded by or followed by the reference signal.

12. The method of claim 7, and further comprising the step of determining that transmissions of the wireless radio signal occur aperiodically, and further comprising steps of transmitting the reference signal periodically, and at each

known location triggering the capture of receive signal sample data for a period of time in response to detecting a transmission of the wireless radio signal.

13. The method of claim 1, and further comprising the steps of transmitting the reference signal from a first known location in response to receiving a transmission of the wireless radio signal at the first known location, and transmitting to each of the other known locations data describing the time delay at the first known location between the reception of the transmission of the wireless radio signal and transmission of the reference signal to enable the determination of the time difference of arrival at the other known location between the wireless radio signal and the reference signal.

14. The method of claim 13, wherein the step of transmitting the reference signal comprises transmitting a probe request signal in accordance with an IEEE 802.11 communication standard.

15. The method of claim 7, wherein the step of transmitting comprises transmitting the reference signal multiple times from multiple antennas of a device, each time using different transmit antenna weights.

16. The method of claim 1, wherein the step of determining produces first and second candidate locations for the target device, and further comprising the step of selecting one of the first and second candidate locations as the actual location of the target device.

17. The method of claim 16, wherein the step of selecting comprises:

a. computing an observed channel response between the target device and a plurality of antennas at each of the first and second known locations based on the second signal received at the plurality of antennas at each of the first and second known locations;

b. computing candidate channel responses between the plurality of antennas for each of at least the first and second known locations and each of the first and second candidate locations; and

c. choosing one of the first and second candidate locations that minimizes a sum-of-squares Euclidean distance between the observed channel response

and the candidate channel responses for the first and second known locations, respectively.

18. The method of claim 17, wherein the step of selecting further comprises the step of normalizing the observed channel response and the candidate channel responses to unity.

19. The method of claim 18, wherein the step of selecting comprises steps of generating for each of the first and second known locations, a measure of confidence that one of the candidate locations is the actual location based on angle-of-arrival of the second signal from the target device; and combining the measures of confidence for at least the first and second known locations to select the candidate location with the greatest total measure of confidence.

20. A system for determining the location of a target device that transmits a wireless radio signal, comprising:

a. a plurality of radio devices that receive radio signals at corresponding known locations; and

b. a computing device coupled to the plurality of radio devices that computes a location of the source of the wireless radio signal based on time differences between arrival of the wireless radio signal and a reference signal at each of the radio devices, wherein arrival of the wireless radio signal at each of the radio devices is determined using receive signal sample data of the wireless radio signal at one of the radio devices as a reference waveform.

21. The system of claim 20, wherein each of the radio devices receives the wireless radio signals and generates receive signal sample data representative thereof, and wherein the computing device selects as the reference waveform one of receive signal sample data from the radio devices.

22. The system of claim 20, wherein the computing device or the respective radio devices correlate receive signal sample data associated with the reference waveform to determine time of arrival of the wireless radio signal at each radio device.

23. The system of claim 20, wherein each of the radio devices generates data describing characteristics associated with its reception of the wireless radio signal, the data including one or more of bandwidth, duration, center frequency and signal strength.

24. The system of claim 23, wherein the computing device compares one or more of the data associated with reception of the wireless radio signal at each of the radio devices to select receive signal sample data as the reference waveform

25. The system of claim 23, wherein the computing device selects the receive signal sample data at the radio device with the strongest received signal strength.

26. The system of claim 22, wherein the computing device sends the receive signal sample data that is selected as the reference waveform to each of the other radio devices, wherein each of the radio devices use the reference waveform to determine the time arrival of the wireless radio signal and to compute the time difference of arrival between the reference waveform and the wireless radio signal.

27. The system of claim 20, wherein a first radio device transmits the reference signal.

28. The system of claim 27, wherein when it is determined that transmissions of the wireless radio signal occur periodically, the first radio device transmits the reference signal prior to a transmission of the wireless radio signal.

29. The system of claim 27, wherein when it is determined that transmissions of the wireless radio signal occur periodically, the first radio device transmits the reference signal after a transmission of the wireless radio signal.

30. The system of claim 27, wherein when it is determined that transmissions of the wireless radio signal occur aperiodically, the first radio device transmits the reference signal periodically in an attempt to cause a transmission of the reference signal to occur just prior to or after a transmission of the wireless radio signal.

31. The system of claim 27, wherein when it is determined that transmissions of the wireless radio signal occur aperiodically, the first radio device transmits the reference signal periodically and the radio devices continuously store receive signal data in a circular buffer in an attempt to capture at least one occurrence of a transmission of the wireless radio signal preceded by or followed by the reference signal.

32. The system of claim 27, wherein when it is determined that transmissions of the wireless radio signal occur aperiodically, the first radio device transmits the reference signal periodically and the radio devices begin capturing receive signal sample data for a period of time in response to detecting a transmission of the wireless radio signal.

33. The system of claim 27, wherein the first radio device transmits the reference signal in response to receiving a transmission of the wireless radio signal.

34. The system of claim 33, wherein the first radio device or the computing device sends to each of the other radio devices data describing the time delay between reception of the transmission of the wireless radio signal at the first radio device and transmission of the reference signal by the first radio device to enable the determination of the time difference of arrival at the other radio devices between the wireless radio signal and the reference signal.

35. The system of claim 20, wherein each of the radio devices comprises a buffer memory that stores receive signal data associated with reception of the reference signal and wireless radio signal from which time difference of arrival of those signals is determined.

36. The system of claim 27, wherein the first radio device transmits as the reference signal a request-to-send (RTS) signal.

37. The system of claim 27, wherein the first radio device transmits as the reference signal a probe request frame in accordance with an IEEE 802.11 communication standard, and wherein the other radio devices are capable of receiving and recognizing the probe request signal.

38. A method for determining a location of a radio device based on a first time difference between arrival of a first signal at a first known location and arrival of a second signal transmitted by the radio device at the first known location, and at least a second time difference between arrival of the first signal at a second known location and arrival of the second signal at the second known location, where samples of the second signal received at one of the first and second known locations are used as a reference waveform to correlate to the second signal in order to determine time of arrival of the second signal.

39. A processor readable medium encoded with instructions that, when executed by a processor, cause the processor to compute a location of a radio device based on a first time difference between arrival of a first signal at a first known location and arrival of a second signal transmitted by the radio device at the first known location, and at least a second time difference between arrival of the first signal at a second known location and arrival of the second signal at the second known location, where samples of the second signal received at one of the first and second known locations are used as a reference waveform to correlate to the second signal in order to determine time of arrival of the second signal.

40. The processor readable medium of claim 39, and further comprising instructions encoded on the medium for comparing data associated with reception of the second signal at the first and second known locations to determine the known location that best receives the second signal, and wherein the receive signal sample data at the known location that best receives the second signal is used for the reference waveform.